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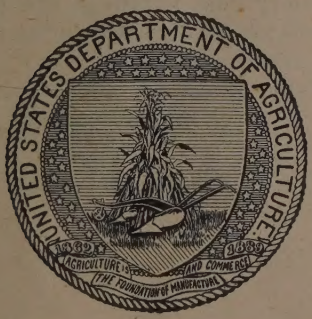
MISCELLANEOUS COTTON INSECTS IN TEXAS.

BY

E. DWIGHT SANDERSON,

Special Agent, Bureau of Entomology, in Cooperation with the Entomological Department, A. and M. College of Texas.



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LETTER OF TRANSMITTAL

U. S. Department of Agriculture,
Bureau of Entomology,
Washington, D. C., April 18, 1905.

Sir: I have the honor to transmit herewith the manuscript of a Report on Miscellaneous Cotton Insects in Texas, prepared by Prof. E. Dwight Sanderson, formerly State Entomologist of Texas.

This report is the result of a year's work on the minor insect enemies of the cotton plant, undertaken by Professor Sanderson and his assistants in order to supplement the work which has been done by the field agents of this Bureau, on the more important injuries by the cotton boll weevil and bollworm. It is written in popular form, and I recommend its publication as a Farmers' Bulletin.

Mr. Sanderson desires to acknowledge the valuable assistance given to him in the conduct of these investigations by Mr. A. C. Lewis, who was in charge of the laboratory at the demonstration farm of Mr. E. H. R. Green, at Terrell, Tex., and to Mr. C. C. Sanborn, who had charge of the laboratory work at College Station. A great part of the life histories of the insects discussed in the report is the result of the work of these gentlemen.

Very respectfully,

L. O. Howard,
Entomologist and Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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MISCELLANEOUS COTTON INSECTS IN TEXAS.

INSECTS WHICH AFFECT THE YOUNG PLANTS.

Prior to the advent of the Mexican cotton boll weevil (*Anthonomus grandis* Boh.) the retardation of the cotton crop on account of replanting, necessitated by the depredations of insect pests on the young plants, was of little importance. But since it is absolutely essential to mature an early crop of cotton if injury by the boll weevil is to be escaped, the matter of the injury to the young plants by other insects becomes a matter of much importance.

CUTWORMS.

As soon as the young plants have started to grow, and often after they have been chopped, many of them are destroyed by cutworms, which cut off the stems and often make replanting necessary over considerable areas.

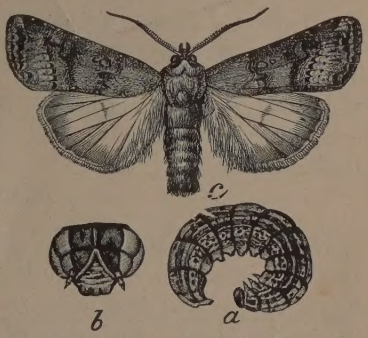

FIG. 1.—*Agrotis ypsilon*, one of the tobacco cutworms: *a*, larva; *b*, head of same; *c*, adult—natural size (after Riley & Howard).

Life history.—The complete life history of the species concerned is not known, but the winter is passed in the larval condition in all stages of growth, and in the southern part of the State more or less damage is done to gardens throughout the winter in open seasons. Early garden crops are injured worst in March, the injury often commencing by the middle of February and continuing until the middle of April or first of May. When full grown the cutworms form oval cells in the soil and transform into pupæ, the adult moths emerging three or four weeks later. The species most commonly found on cotton in 1904 were the black cutworm (*Agrotis ypsilon* Rott.), the moths and larvæ of which are shown in figure 1, and the shagreened cutworm (*Feltia malefida* Guen.). Injury to cotton by cutworms was not as serious in 1904 as often occurs, and it is probable that several species other than those mentioned above were concerned. The moths appear from the

middle of May to the middle of July. Both larvæ and moths are nocturnal insects, the larvæ feeding and the moths flying only at night. Planters report that cutworms are more abundant in seasons following a fall in which there have been abundant rains, making grass and weeds plentiful, and that these insects are more injurious at the sides of the fields, where, of course, vegetation was probably abundant the fall previous.

Remedies.—From the habits above outlined it may be seen that much can be done to control these pests by thorough cultivation of the land during late fall, winter, and early spring. When the land is thoroughly plowed many of the cutworms are exposed to abnormal weather and succumb, many are crushed, and still others are eaten by birds or insects. Then, too, when the land is fallow in early spring there is nothing upon which the cutworms can feed and these starve before the cotton is planted. If found abundant in spring, however, they may be best combated by the use of poisoned traps. The mash described on page 10 for grasshoppers will be found very satisfactory, but is rather expensive for large areas. In its place, grass, clover, or other rank vegetation poisoned with Paris green will be found effective if scattered over the field in small bunches a few days before the plants appear. Bunches of the grass may be dipped in Paris green, 1 pound to a barrel of water, or a small area of grass or clover may be thoroughly sprayed and then cut and distributed from a wagon. These traps will be most successful where the land has been plowed some time before, for cutworms will often feed for several days where there is much vegetation which has been but recently turned under.

PLANT-LICE.

With the formation of the first true leaves of the cotton, winged plant-lice or aphids appear in large numbers on the under side of these leaves and on the terminals, the "buds" of the plants often being black with them. Almost all of these are of the same species as that which infests melons later in the season, namely, *Aphis gossypii* Glov. (fig. 2). It may not be out of place, therefore, to call attention to the undesirability of planting cotton between rows of melons, as is often done. The plant-lice migrate to the cotton at this time from various common weeds upon which they have passed the winter.

Another plant-louse, *Aphis* sp., which is most commonly found on bur clover, occurs on the cotton plant at the same time and can not easily be distinguished from the first-mentioned species. In cold weather these plant lice often cause considerable injury to the cotton plants and greatly retard their development, since they multiply very rapidly and feed mostly on the growing terminals. If there be a few

warm days, however, hordes of small parasitic flies appear and in a few days often completely rid the plants of aphids.

Remedies.—Although these plant-lice may be readily destroyed by spraying with kerosene emulsion, whale-oil soap, or tobacco water, as the writer has demonstrated, yet it would hardly seem, judging from his observations, that the use of these insecticides will as a rule be profitable in this particular case. Fall and winter plowing which will keep the fields clear of weeds during the winter will undoubtedly have a

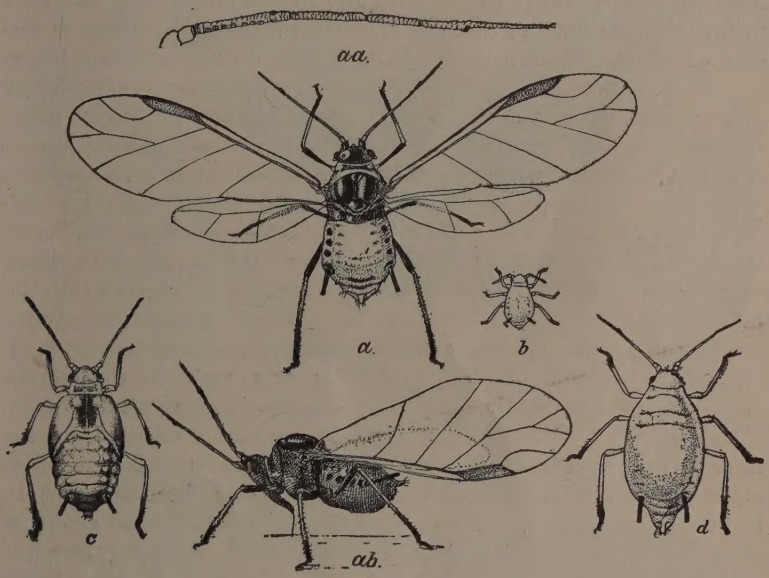

FIG. 2.—*Aphis gossypii: a*, winged female; *aa*, enlarged antenna of same; *ab*, dark female, side view; *b*, young nymph or larva; *c*, last stage of nymph; *d*, wingless female—all greatly enlarged (after Chittenden).

beneficial effect in reducing the numbers of plant-lice, and in some cases will be the only treatment necessary.

THE GARDEN WEBWORM.

The so-called "webworms" or "careless worms" (*Loxostege similalis* Guen.) often destroy young cotton and corn over considerable areas, as was especially the case in northern Texas and in Oklahoma in 1903. The name "careless worm" is derived from the normal food plant of the species, the "careless weed" (Amaranthus), upon which these webworms always feed by preference. It is in fields grown up to these weeds that the caterpillars are always worst, and if these are kept down the insects will be much less troublesome.

Life history.—The winter is passed in the ground either in the larval or pupal stage and the first moths appear by the middle of April. These moths are of a yellowish-buff color, with markings as shown in figure 3, *a*. Their eggs, which, to the number of 50 per moth, are deposited in bunches of from 8 to 20 upon the leaves of the food plant, and hatch in about three days. The larvæ of the first two broods feed upon weeds, or often upon alfalfa, where that is grown, in which case they are driven to migrate to adjoining cotton when alfalfa is cut. The full-grown caterpillars are slightly over an inch long and of a yellowish or yellowish-green color, marked with shining black tubercles, or warts, as shown in figure 3, *b*. The second brood of larvæ, which occurs in late May and the first half of June, is the one most injurious to cotton. In feeding, the caterpillars spin a fine web which envelops the leaves of the young cotton plant. When full grown they enter the soil and there transform to pupæ (see fig. 3, *f*), from which the moths emerge in about eight days, or just a month from the time the eggs were laid. As a rule, no appreciable injury is inflicted on older cotton, but in August alfalfa is often damaged. There seem to be five, and possibly six, broods a year in Texas. Corn and all kinds of garden vegetables are injured at about the same time as is cotton.

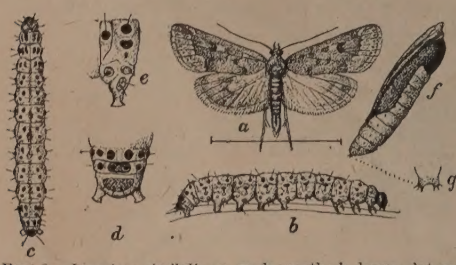

FIG. 3.—*Loxostege similalis: a*, male moth; *b*, larva, lateral view; *c*, larva, dorsal view; *d*, anal segment; *e*, abdominal segment, lateral view; *f*, pupa; *g*, cremaster—*a*, *b*, *c*, *f*, somewhat enlarged; *d*, *e*, *g*, more enlarged (reengraved after Riley, except *c*, from Chittenden).

Remedies.—It is evident that fall and winter plowing, not only of cultivated land but also of adjoining fields grown up to weeds, is the most effective means of controlling this pest. Upon their appearance the caterpillars may be easily destroyed by dusting with Paris green or any similar arsenical which will not burn the foliage. This may be best accomplished by means of a powder gun which will distribute a small but ample amount of the poison evenly over the plant, thus economizing in the amount of material used and avoiding the burning of the tender foliage which might result from the heavier application by means of a bag. The planter will find that the prompt application of Paris green will be entirely effectual.

THE WHITE-LINED SPHINX CATERPILLAR.

The larvæ of the white-lined sphinx moth (*Deilephila lineata* Fab.) are common inhabitants of fields of young cotton, but usually do not work any appreciable amount of injury. They are subject to consid-

erable variation in color, being either yellowish-green with black eye spots and faint stripes, or black with yellowish spots, as shown in figure 4. They may be readily distinguished from all other caterpillars on cotton by the pointed horn at the end of the body. Occasionally they become excessively numerous and, assembling in great numbers, somewhat like the army worm, destroy all low-growing vegetation in their path. Such was the case in 1903, when late in May serious damage

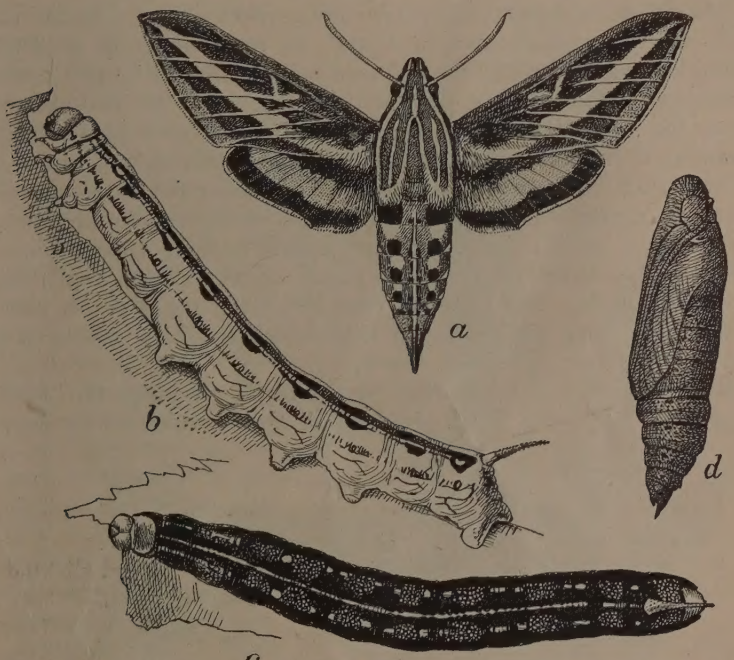

FIG. 4.—*Deilephila lineata: a*, moth; *b*, pale larva; *c*, dark form of larva; *d*, pupa—all natural size (from Chittenden).

was inflicted on cotton and garden crops in several localities in southwestern Texas.

Life history.—When full grown the caterpillars enter the earth to pupate and the moths emerge about July 1. Usually most of the moths fail to emerge, however, as the caterpillars are parasitized by one of the tachina flies to such an extent that but few transform. The second brood is therefore very small and does no harm. The winter is passed in the soil in the pupal stage.

Remedies.—The favorite food of these caterpillars is purslane, though many succulent weeds are among its common food plants. Here again, therefore, the destruction of these weeds and thorough winter plow-

ing are the best means of control. The caterpillars are readily seen and may easily be destroyed by hand while chopping the cotton; and this should be done, as one caterpillar can destroy several plants if left unmolested. When present in large numbers they may be readily destroyed by dusting the vegetation upon which they are feeding with Paris green.

GRASSHOPPERS.

The differential locust (*Melanoplus differentialis* Thos.) is by far the most injurious grasshopper in Texas. In the summer of 1903 the adults severely injured cotton and corn in the south-central part of the State; and in the spring of 1904 the young, just after they had hatched from the eggs, destroyed the young cotton and corn plants to an alarming extent throughout several counties in this section, but particularly in the bottom lands along the Brazos River and its tributaries. The eggs commenced to hatch in numbers by the middle of March, 1904, and by April 1 the young were present in many fields in countless numbers, destroying the young plants and necessitating replanting over large fields. The eggs had been laid along the edges of cultivated fields, along ditches, and in fields which had been uncultivated the previous year. (See figs. 5 to 8.)

Remedies.—It was found that by thoroughly dusting the weeds around the fields with Paris green, either pure or diluted with flour,

FIG. 5.—*Melanoplus differentialis:* adult—enlarged (original).

great numbers of the nymphs were killed. In addition, a large spoonful of poisoned bran mash was placed every 3 feet in the row throughout the fields and the plants were dusted. This treatment proved very effective, 20 or 30 dead grasshoppers being found near a pile of the mash. This mash is made by stirring 1 pound of white arsenic or Paris green into 25 pounds of bran or middlings and then adding 1 quart of cheap molasses diluted with sufficient water to thoroughly moisten the whole mass, but not so much as to make it doughy. If too moist it cakes too quickly in the sun. It was found that the mash was nearly as effective without the molasses. Where the young hoppers occurred in immense numbers—for they often formed a small cloud when first disturbed—they were sprayed with pure kerosene or crude petroleum, or a soap emulsion containing

about 15 per cent kerosene or crude petroleum. Results with the pure oils were more quickly apparent, so that these were preferred by the planters. Thousands of grasshoppers were thus destroyed within a few square feet. By a thorough use of these methods, as local circumstances warranted, the planters were able to so reduce the numbers of grasshoppers that they did but little damage after the latter part of April. About this time, also, large flocks of ricebirds and blackbirds appeared and fed on the grasshoppers for several days. Had the outbreak remained unchecked several replantings would have been necessary, and a recurrence of the pest the next season would have been probable.

FIG. 6.—*Melanoplus differentialis* on corn leaves: adult in natural position, upper figure; pupa skin below on right—enlarged (original).

This outbreak, as well as the previous ones, was undoubtedly due to the large areas of uncultivated land in the river bottoms in 1903, as a result of the floods of the summer of 1902 and the spring of 1903. These uncultivated fields, grown up to rank weeds which are the favorite food of the grasshoppers and with a hard, baked soil, furnished an ideal place for them to multiply and in which to lay their eggs in the fall of 1903. From these fields and from uncultivated fence rows the young emerged in the spring of 1904, and in many cases it was difficult to successfully cope with them, owing to the fact that the fields from which they emerged remained uncultivated and in them nothing was done toward checking the pest.

The grasshoppers become full grown late in June, and the eggs are laid in the ground during August and September, usually in a firm, hard soil such as that described above. It is evident, therefore, that where large areas of land are left uncultivated and wide strips of

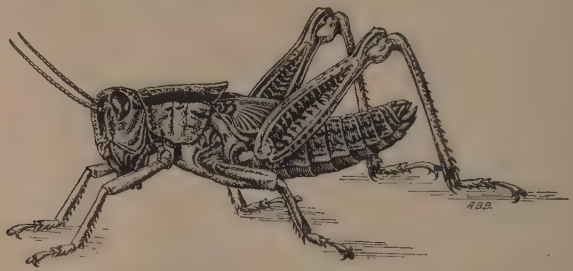

FIG. 7.—*Melanoplus differentialis:* young nymph—enlarged (original).

uncultivated ground grown up in weeds surround the fields, an ideal place is furnished for the grasshoppers to multiply and oviposit; and being too numerous to subsist upon the vegetation there found, the young hatching from these eggs migrate to fields of cultivated crops. It has been repeatedly demonstrated that the very best method of controlling such outbreaks is to thoroughly plow and harrow all land where the eggs are laid in the fall as soon as possible after they are deposited. If this be done serious injury will be rare, but if neglected the planter should be prepared to combat the young as soon as they hatch with the remedial measures above outlined, for they are by no means so easily or effectively poisoned when full grown or nearly so.

FIG. 8.—Egg mass of *Melanoplus differentialis*—enlarged (original).

The large lubber grasshopper.—In southwestern and west-central Texas the large lubber grasshopper (*Brachystola magna* Gir.) (fig. 9)

FIG. 9.—*Brachystola magna* (original).

often occurs in large numbers and destroys fields of cotton, as it takes but a short time for one of these huge insects to ruin a plant. The chief damage is done late in May and in June and mostly to cotton, this crop seeming to be a favorite with them, though they are found in

pastures far away from farms. The habits of this species are not well known, but it seems probable that the grasshoppers deposit their eggs in grass land, as it is said that they are not injurious where hogs are allowed free range. They may be controlled by a liberal use of the poisoned bran mash above described, but it should be applied as soon as they appear.

WINGLESS MAY BEETLES.

Two species of wingless May beetles (*Lachnosterna lanceolata* Say and *L. cribrosa* Lec.) often seriously injure young cotton, as well as various other crops, especially garden truck, in the arable land west of the ninety-seventh meridian. Frequently they occur in immense numbers and cut off the young cotton plants over a large field. As they are wingless they may be readily caught by hand picking or they may be poisoned by dusting the plants and all weeds with Paris green.

FIG. 10.—*Lachnosterna lanceolata:* female—somewhat enlarged (original).

The first of these species (fig. 10) is of a grayish tinge, and is more injurious in west-central counties than elsewhere, although it also occurs in northern Texas. It feeds upon careless weed (Amaranthus) and wild sunflower (Helianthus). *L. cribrosa* (fig. 11) has been reported from all parts of northwestern Texas as injurious to cotton and all sorts of garden stuff. It prefers the ragweed to all other food plants. A third species (*L. farcta* Lec.) is more common in the southwestern part of the State, where it has often been injurious. It has similar habits to the wingless species, but is usually provided with wings.

FIG. 11.—*Lachnosterna cribrosa:* female—enlarged (original).

The species have much in common, although the complete life histories and habits are not known. The last two species emerge from the soil—where they remain hidden during the day—about an hour before sundown and feed from then until dusk, when they return to the holes left or make new ones. Their globular, colorless eggs are laid in June about two inches deep in the soil, and the larvæ feed on the roots of various weeds and grasses but have never been observed as injurious. It has been noted that the beetles are the most injurious where a field has been allowed to grow up to weeds the previous summer, and that where the land has

been plowed in the winter and cultivated in early spring they are by no means as abundant as usual.

INSECTS WHICH INJURE THE LEAVES.

The salt-marsh caterpillar (*Estigmene acræa* Dru.). This is one of the so-called "woolly bear" caterpillars, being about two inches long, black, and covered with long black and red hairs. (See fig. 12.) The caterpillars have been reported as stripping cotton of its foliage in May at Paris, Tex., in 1885, and in July in southern Texas in 1903. The loose cocoon in which the larva transforms to the pupa is made among

FIG. 12.—*Estigmene acræa: a*, female moth; *b*, half-grown larva; *c*, mature larva, lateral view; *d*, head of same, front view; *e*, egg mass—all slightly enlarged except *d*, more enlarged (from Chittenden.)

the leaves of the cotton or more often in rubbish on the ground. From these the moths emerge in about two weeks, the complete life cycle occupying about forty-five days. There are probably four broods in a year. These caterpillars have been reported to be unsusceptible to poisoning with Paris green when full grown, but like many others could probably be killed without difficulty if poisoned while still young.

The arge tiger moth (*Apantesis arge* Dru.). A similar caterpillar is common upon cotton, but has never been as injurious as is the salt-marsh caterpillar.

The beet army worm (*Caradrina exigua* Hbn.). A small green caterpillar, about an inch long, which in Colorado and California has been a serious enemy to sugar beets and is known as the beet army worm,

is worthy of note on account of its past records elsewhere. It has been found commonly in northern Texas feeding on cotton foliage and eating into the squares. The different stages are shown in figure 13. It is readily controlled by means of arsenicals.

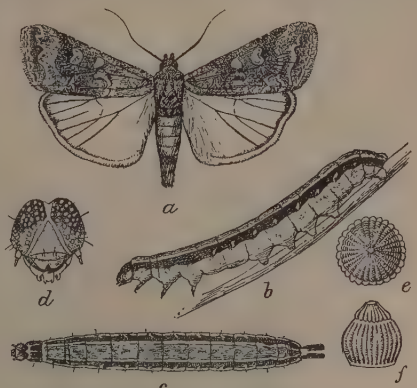

FIG. 13.—*Caradrina exigua:* *a*, moth; *b*, larva, lateral view; *c*, larva, dorsal view; *d*, head of larva; *e*, egg, viewed from above; *f*, egg, from side—all enlarged (*e*, *f*, after Hofmann; *a*–*d*, after Chittenden).

The fall army worm (*Laphygma frugiperda* S. & A.).—Occasionally the larvæ of the fall army worm stray into the cotton fields when they become excessively abundant—in late summer or early fall—and sometimes do local injury to the foliage.

The Io moth (*Automeris io* Fab.).—The green, spine-covered larvæ of this moth are not uncommon on cotton and will be easily recognized if handled, as the prick of the spines is poisonous.

The cotton-boll cutworm (*Prodenia ornithogalli* Guen.) (figs. 14 and 15).—Throughout the season the caterpillars of this so-called cutworm

FIG. 14.—*Prodenia ornithogalli:* dark form, male, above; pale form, female, below—somewhat enlarged (from Chittenden).

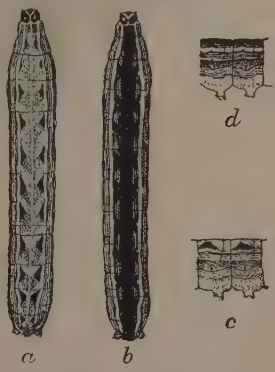

FIG. 15.—*Prodenia ornithogalli:* *a*, pale form of larva; *b*, dark form of same; *c*, lateral view of abdominal proleg segments of pale form; *d*, same of dark form—all enlarged (from Chittenden).

are found eating the foliage and boring into the squares and bolls much as does the bollworm. But in habits they are quite different from the true cutworms, feeding by day and not cutting off the stems of the young plants. The olive or greenish-brown caterpillars may

be readily recognized by the two rows of triangular, velvety-black spots extending down the back, as shown in figure 15. Four or five broods occur in a year in Texas. These caterpillars have never been reported as seriously injurious to cotton, but they often do considerable local damage to the squares and bolls. By picking them off of the young cotton when chopping in the spring, they may be largely controlled.

Leaf-cutting ant (*Œcodoma fervens* Say.).—Especially in southern Texas, cotton, as well as fruit trees and garden crops, often suffers from the devastations of the leaf-cutting ants, which cut off pieces of the leaves and carry them to their nests. Here they form the founda-

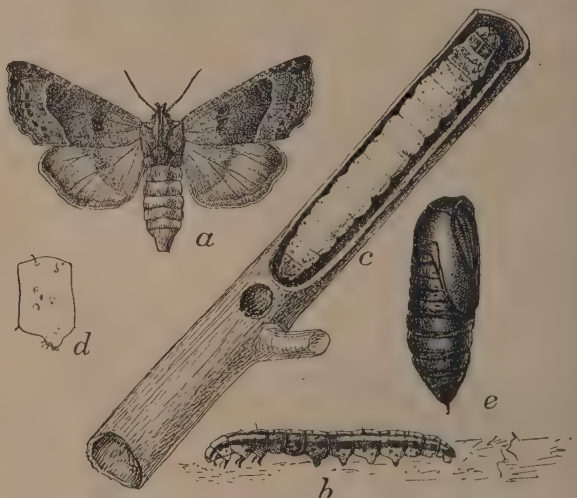

FIG. 16.—*Papaipema nitela:* *a*, female moth; *b*, half-grown larva; *c*, mature larva in injured stalk; *d*, lateral view of abdominal segment of same; *e*, pupa—all somewhat enlarged (from Chittenden).

tion upon which grows a fungus which is the food of the larvæ. These ants are one of the worst insect pests in the Tropics. Recently Prof. M. T. Cook, entomologist of the Cuban department of agriculture, has found that by sprinkling Paris green freely around the entrances of the nests the ants will carry it into the nests and the larvæ will be killed by it at slight expense. This promises to be the best means of controlling the ants where there are many nests, as in Cuba. The remedy which has been most used for this and ants with similar habits consists in injecting carbon bisulphid (locally known in Texas as "high life") and then closing the holes with earth. The heavy fumes will descend into the nest and destroy the occupants. The amount necessary will depend upon the size of the nest, as an individual nest is often quite large.

INSECTS WHICH INJURE THE STALK.

A number of insects are frequently found boring into or otherwise injuring the stalks, but we know of no case in which the injury has been serious.

The stalk borer (*Papaipema nitela* Guen.) (fig. 16).—This insect, which is quite different from other common borers, being black, with white stripes in its early stages, has been noticed boring into the stems several inches above the ground and causing the plants to wilt. It commonly feeds in various weeds, most commonly in the so-called "bloodweed."

The small jet-black beetles of *Amphicerus fortis* Lec., nearly related to the apple twig-borer, are often found in considerable numbers in the old cotton stalks in the spring, but have never been noted as injuring the growing plants.

The cotton-stalk borer.—One of the long-horn beetles, *Ataxia crypta* Say, whose larvæ commonly bore in the stalks of the cocklebur, sometimes bores into cotton stalks otherwise injured, but is not known to injure healthy plants.

The snowy tree cricket (*Œcanthus niveus* DeG.).—Mention should be made of the eggs of this insect, which are deposited in the stalks of cotton and various common weeds in the fall, since they have been frequently thought to be eggs of the boll weevil. These eggs are laid in a long row, leaving a long scar, composed of numerous punctures on the surface. They are deposited in the fall after the cotton is about grown and do no harm, so far as we are aware. The young which hatch from them the following spring, as well as the adults, feed very largely upon plant-lice, and are therefore more beneficial than injurious.

INSECTS WHICH INJURE THE SQUARES AND BOLLS.

The cotton square-borer (*Uranotes melinus* Hbn.).—During late May and in June cotton squares are often bored into by a small green caterpillar which many planters consider a stage of the bollworm and others have called the "sharpshooter." Injury from this cause is often quite serious for a short time on a small area, as we have seen 10 per cent of the stalks entirely denuded of squares in small fields where this insect is abundant. The caterpillars hollow out the squares in the same manner as does the bollworm, often destroying all of those on a plant knee high and even boring into the stalk. They are bright green, oval, decidedly flattened, covered with short hairs which give them a velvety appearance, and with the head retracted under the front of the body, being quite unlike any stage of the bollworm. They are the larvæ of a dainty little butterfly (shown slightly enlarged

in fig. 17) which is very common around cotton fields. The eggs are laid on the leaves and stems of cotton, cowpeas, goatweed and various weeds. The larvæ have also been commonly found on hops, beans, and cowpeas, and seem to prefer the latter to cotton.

Fortunately for the planter, the large majority of the caterpillars are usually parasitized by flies about the size of the housefly and also by small, wasp-like hymenopterous insects. The parasitic flies lay their eggs upon the caterpillar, and the maggots hatching from them bore into the caterpillar and feed upon its tissues, ultimately killing it and emerging from it or the pupa as adult flies. Over 90 per cent of the June brood have been found thus killed. It is usually hardly worth while, therefore, to attempt to combat this insect, as it is not often seriously injurious in the same locality year after year. Should remedial treatment be necessary, thorough dusting with Paris green would probably answer the purpose, as the young caterpillars, as do bollworms, feed to some extent upon the foliage before entering the squares.

FIG. 17.—*Uranotes melinus:* *a*, dorsal view of butterfly; *b*, butterfly, with wings closed; *c*, larva from side; *d*, pupa; *e*, egg—all somewhat enlarged, except *e*, greatly enlarged (all except *e* redrawn from Howard).

Cotton "sharpshooters."—Every summer late in July and August frequent reports are made of considerable injury to cotton by "sharpshooters," especially on low land. These insects are reported to puncture the squares and bolls, causing them to drop prematurely, a small black speck showing the point where punctured.

FIG. 18.—*Homalodisca triquetra:* adult at left, last stage of nymph at right, young nymph below—all enlarged (original).

Very few planters, however, are able to identify the insect blamed for the trouble. The insect which has commonly been credited with this work is the glassy-winged sharpshooter (*Homalodisca triquetra*

Fab.) (fig. 18), but with it are associated several near relatives with similar habits—*Oncometopia undata* Fab. (fig. 19), *O. lateralis* Fab. (fig. 20), and *Aulacizes irrorata* Fab. (fig. 21). Many planters know these insects as "dodgers," from their habit of quickly dodging to the opposite side of the stem when disturbed, and those familiar with them have thought them harmless.

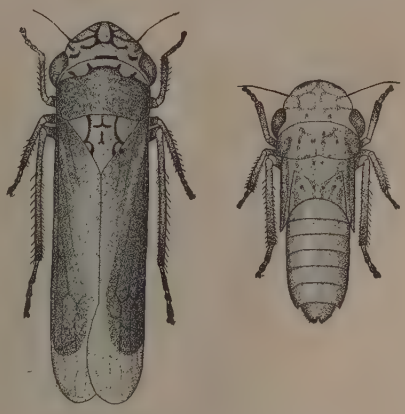

FIG. 19.—*Oncometopia undata:* adult at left, nymph at right—greatly enlarged (original).

Extended observation during two seasons has failed to show any injury to cotton done by these insects. Repeated experiments with the insects in confinement have failed to show that they ever puncture the squares and bolls. There seems to be not the slightest evidence that the insects are ever injurious to cotton, and the supposed injury is undoubtedly due to a physiological condition of the plant which, at the season when the supposed injury occurs, causes a marked shedding of the fruit.

FIG. 20.—*Oncometopia lateralis:* adult and nymph—greatly enlarged (original).

The adult insects hibernate in rubbish on the ground near the food plants and appear in early spring on the elm, yaupon, hackberry, redbud, cottonwood, willow, and the tender shoots of other trees, especially on bottom land along the streams, where these trees are most common. Here they suck the juices of the tender leaves and terminals and deposit their eggs in the tender leaves and stems. The eggs are laid in a row of 10 to 15, side by side, just under the surface of the leaf, forming a blister-like mark. They hatch in a few days and the young bugs feed in the same places as do their parents. The young bugs, or nymphs, shown in figures 18, 19, 20, are grayish or yellowish in color and resemble the adults,

FIG. 21.—*Aulacizes irrorata:* adult—much enlarged (original).

except that they lack wings. Two or three annual generations occur in Texas. The insects are not usually common on cotton until midsummer, and even then are by no means as abundant as on the trees mentioned. They are exceedingly fond of banana trees, sorghum, and sunflowers, sometimes injuring the latter considerably. Records of any injury to cultivated crops by the glassy-winged sharpshooter, the most common species on cotton, are exceedingly rare and doubtful, and there is no evidence whatever for considering it an enemy to cotton.

The cotton leaf-bug (*Calocoris rapidus* Say).—This insect was the

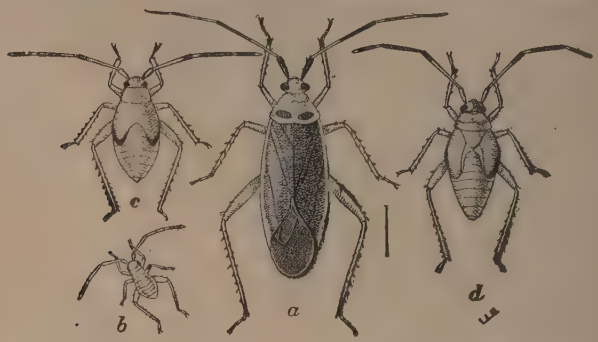

FIG. 22.—Cotton leaf-bug, *Calocoris rapidus: a*, mature bug; *b*, young nymph; *c*, fourth stage of nymph; *d*, fifth stage of young (original).

cause of considerable damage in northern Texas in August and September, 1904. It punctured the squares and young bolls, either causing them to drop, or making the bolls shrivel or decay where punctured. The punctures in the bolls are indicated by small round black spots resembling diseased places, which gradually become larger and sunken (fig. 23). This insect has been known as a common inhabitant of cotton fields for many years, but injury seems to have been rare. It may be readily recognized by the bright red spots just beyond the middle of the wing. The young are shown in figure 22, and are light green marked with red. Several annual generations of the insect occur, but its habits outside of the cotton field are unknown. No successful means of combating it has yet been devised.

FIG. 23.—Cotton boll showing punctures of *Calocoris rapidus* (original).

Other plant-bugs.—Similar injury to bolls, causing black spots and shrinking or decay, is caused by the large green plant bugs variously known as "pumpkin bugs," "stink bugs"—from the very disagreeable odor emitted—and by other local names.

The most common of these is *Nezara hilaris* Say, shown in figure 24. It is bright green in color, and is undoubtedly a decidedly injurious insect, as it has been known to attack orange trees in Florida and strawberries and other garden crops elsewhere.

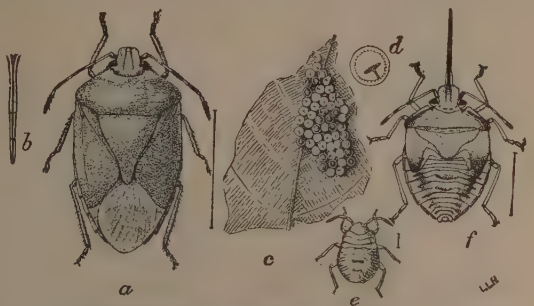

FIG. 24.—*Nezara hilaris: a*, mature bug; *b*, beak of same; *c*, egg mass; *d*, single egg; *e*, young nymph; *f*, last stage of nymph—all enlarged; *b*, *d*, more enlarged (from Chittenden, unpublished).

The leaf-footed plant-bugs (*Leptoglossus phyllopus* Linn. and *L. oppositus* Say) (figs. 25 and 26) injure the bolls in the same manner. These insects are also serious enemies of peaches and tomatoes in Texas. They breed commonly on thistles and should be destroyed wherever found.

Two other bugs somewhat resembling the so-called "cotton stainer," though of a slaty or bluish color, margined with yellow or red, *Largus*

FIG. 25.—*Leptoglossus phyllopus*, twice natural size (after Hubbard).

FIG. 26.—*Leptoglossus oppositus*—twice natural size (from Chittenden.)

succinctus Linn. and *Jadera hæmatoloma* H.-Schf., are frequently found in considerable numbers on the bolls and do some damage. The young nymphs feed upon low-growing weeds and have not been observed on cotton. There is no evidence of any injury in Texas by the so-called "cotton stainer" (*Dysdercus suturellus* H.-Schf.).

Click-beetle.—A small species of click-beetle (*Monocrepidius vespertinus* Fab.), shown in figure 27, is frequently found on cotton blossoms

and squares and working around holes made by the bollworm or square borer. It is of interest because frequently mistaken for the boll weevil where that insect is not well known. There is some evidence that these beetles sometimes eat into a square, but if so, the injury is rare and inconsequential.

FIG. 27.—*Monocrepidius vespertinus*—enlarged (from Chittenden).

The cowpea-pod weevil (*Chalcodermus æneus* Boh.) (fig. 28).—This is commonly an enemy of cowpea, working in the pods and seeds of the developing peas, but has been observed eating into the stems of young cotton plants and sometimes attacking the young squares in Texas, Louisiana, and Georgia, the injury being more severe in the latter State, where cowpeas are more commonly raised. It is frequently mistaken for the boll weevil.

FIG. 28.—*Chalcodermus æneus*—enlarged (from Chittenden).

Bruchus amicus Horn.—This small gray beetle, which quite closely resembles the pea weevil, has been observed upon cotton squares in southwestern Texas and was thought to be injurious, but was probably merely feeding upon nectar, as it breeds in the pods of the mesquite.

Acorn weevils.—Various species of acorn weevils (*Balaninus* spp.) are frequently found on cotton, especially near woods, and may occasionally be seen feeding on squares. They never do material injury, but may easily be mistaken for the boll weevil by those unacquainted with the latter pest.

FIG. 29.—*Epicauta lemniscata*—enlarged (from Chittenden).

Blister beetles.—Blister beetles of various species (*Epicauta vittata* Fab., *E. lemniscata* Fab. (fig. 29), *E. cinerea* Forst., and *E. ferruginea* Say) are frequently found eating holes in the cotton flowers, but never in sufficient numbers to cause material injury.

A large number of common insects are found upon the cotton plant, some frequenting it habitually and others merely accidentally, but the above are the only ones observed as injurious in Texas in recent years.

CONCLUSION.

It will have been observed that most of the common insect enemies of cotton above described naturally feed upon various common weeds which grow up in neglected or uncultivated fields, and that, by the destruction of such weeds, and winter plowing where they have grown, the insects

inhabiting them will be largely controlled. The thorough cultivation, during the late fall, winter, and early spring, of all land to be planted, or which has been infested, will also be the means of greatly reducing their numbers by killing many of the stages then hibernating in the soil. These two general principles must be relied upon to a large extent for the control of most of the minor cotton insects. When they become overabundant those leaf-eaters which chew their food may be poisoned with Paris green or other arsenicals, used as a dust or made into a mash with bran.

More intensive cultivation will undoubtedly result in a material lessening of injury by these pests, for in the eastern cotton-growing States they are by no means as injurious as in Texas, so far as the records indicate. The better methods of cotton culture generally recommended by this Department during the past few years will undoubtedly result in the lessening of injury by all the more common cotton insects.

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